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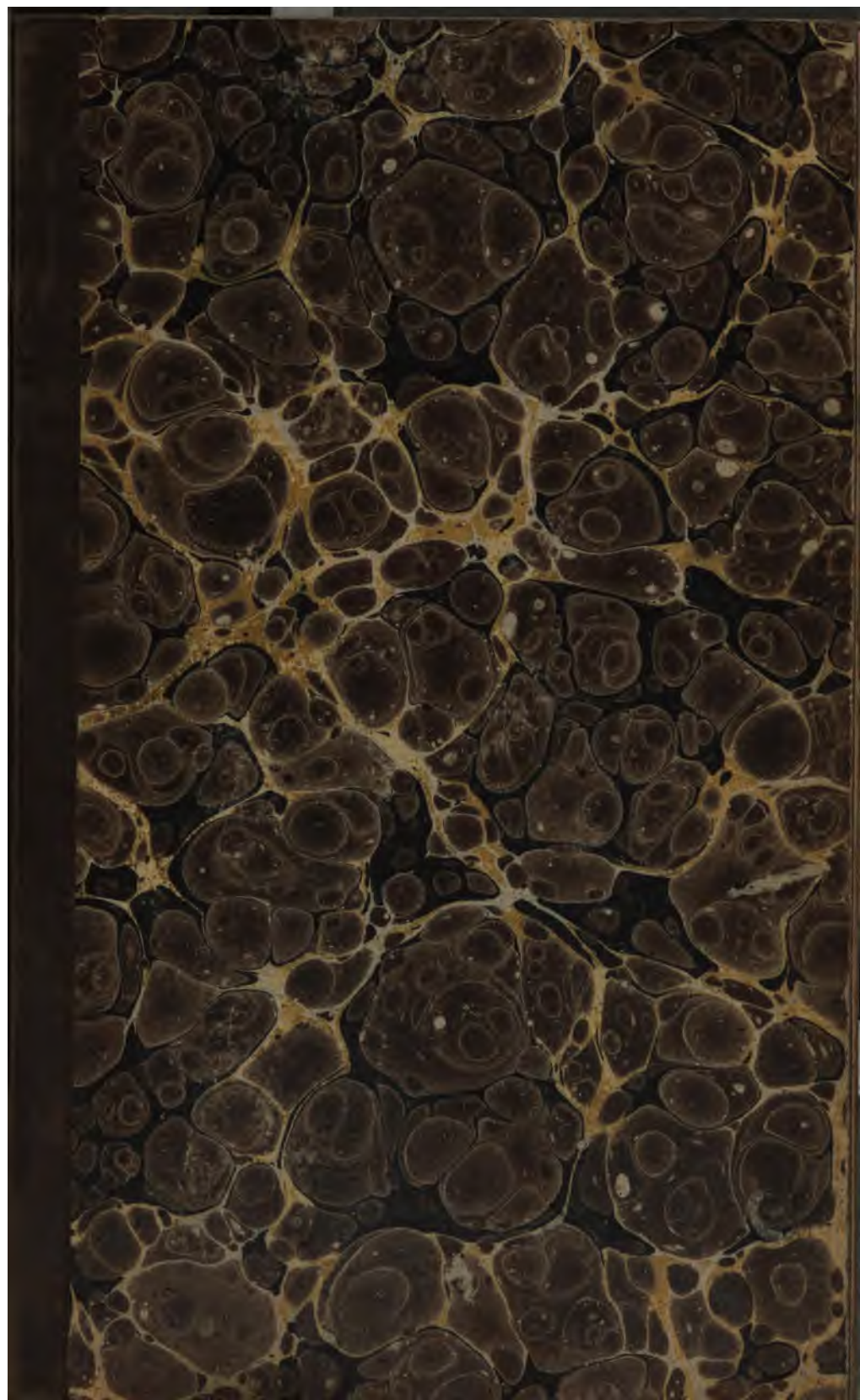
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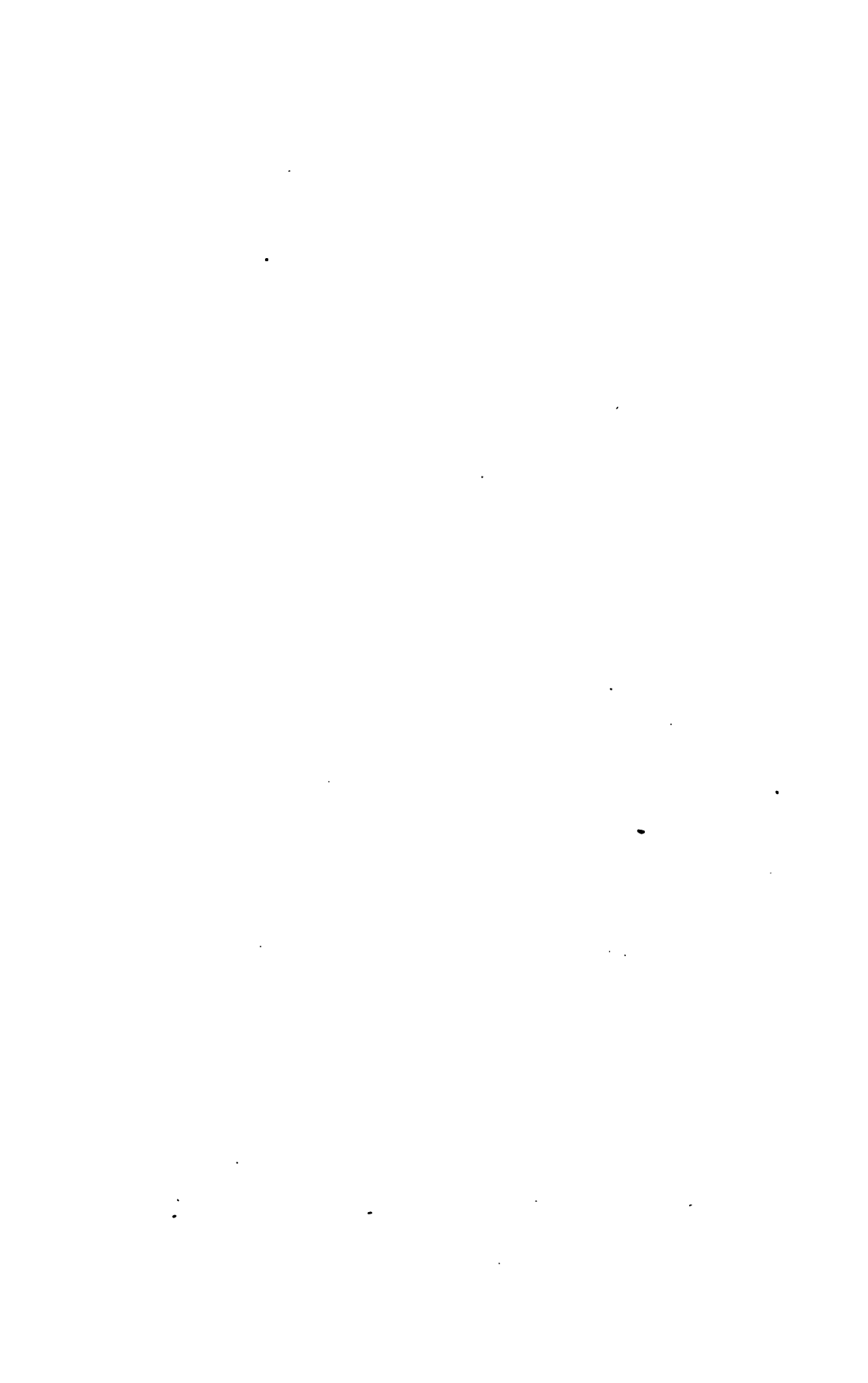
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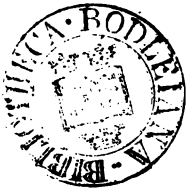




THE  
3  
REVENUE IN JEOPARDY

FROM  
**Spurious Chemistry,**

DEMONSTRATED  
IN RESEARCHES UPON WOOD-SPIRIT AND  
VINOUS-SPIRIT.

BY  
  
**ANDREW URE, M.D., F.R.S., &c.,**

ANALYTICAL CHEMIST TO THE BOARD OF CUSTOMS.

LONDON:  
JAMES RIDGWAY.

1843.





## PREFACE.

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THE well-being of the country, amidst the financial difficulties which now oppress it, the protection of the national revenue, and the vindication of the principal Board for administering its laws, constrain me most reluctantly to make the present appeal to men of business and science. Placed in the painful predicament of either betraying my professional functions, or of exposing the mischievous errors of two individuals whom I have been always accustomed to esteem both as gentlemen and men of science, no alternative is left to an honest man, but to sacrifice private feelings to public duty.

During the preceding ten years, I have been occasionally consulted as an analytical Chemist, concerning various commodities of importation, by the Hon. Commissioners of Customs, and have had the good fortune to merit and obtain their confidence in the results of my analyses, and in my professional reports. In this long period of probation, out of several hundred cases, some of them delicate and complex, not one has been found in fault, so as to put either the revenue or its collectors in jeopardy. I hold, however, no official appointment, and receive no salary, being paid, as other Chemists were paid before me (and in some special instances since my employment), two guineas for each analysis, whether difficult or easy, whether costing the labour of two days or two hours. In some years, twenty or thirty cases may have occurred, in others, as in the last year, only five or six, so that the emolument cannot be an object of cupidity to a professional man of any respectability. If the employment be deemed an honour, it is not without its anxieties and its dangers, as will presently appear.

It was in the sequel of my long course of experiments on sugar-refining, undertaken at the request of the Right Hon. the Lords of the Committee of the Privy Council for Trade and Plantations,

in order to settle the relation between the drawbacks on refined sugars, and the import duty on raw sugars, that I was first consulted professionally by the Board of Customs\*. About that time, viz., nine or ten years ago, a good deal of sugar began to be imported in the state of concentrated cane-juice, upon which the duty was ordered to be levied, at the rate of twenty-four shillings per cwt. for the crystallizable portion, and of nine shillings for the molasses. Samples of this rich cane-juice were sent for analysis to a considerable chemical establishment in London, where, by an unskilful process of boiling, they were converted entirely into molasses—an easy transition, to which cane-juice is very prone, but from which it cannot be restored to sugar by any means. The revenue suffered a proportionate defalcation in consequence of such a defective mode of analysis. When a similar cane-juice was afterwards entrusted to me, it yielded a product in granular sugar, greater, as was alleged by the sugar-refiners, than it would produce in their operations on the large scale. Be this as it may, the revenue was protected in this department, as the President of the Board of Trade (Mr. Poulett Thomson, afterwards Lord Sydenham) stated in his place in the House of Commons, and the sugar-refiners soon adopted such improvements in their business, as to obtain the same proportion of saccharine grain out of the cane-juice which I did, so that the dispute was quietly adjusted. Since then, the Hon. Commissioners have called upon me very generally to examine and report upon sundry kinds of merchandize of uncertain nature or quality, and they have found my decisions to be so correct and reasonable,

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\* The results of these experiments made upon nearly 100 tons of sugar, tended to disclose an annual drainage of the exchequer of upwards of £300,000, secretly involved in the drawbacks. For this irksome and invidious labour of two years, I was paid at the rate of £400 per annum, being less than half the sum which I was under engagements to earn, and could have realized by literary productions: but for this task I was disqualified for other two years by the deprivation of my health, in superintending the sugar-house, amidst many difficulties.

as to be acquiesced in eventually by the fair trader. The business of the Board has never, in my experience, been obstructed in any matter connected with my analyses, till the recent affair of Messrs. Tennants, Clow and Co. of Liverpool, which forms the immediate motive of the present publication.

The attorney-general, Sir Frederick Pollock, takes occasion sometimes, in addressing a jury, after his cross-examination of scientific witnesses, to taunt the *philosophers*, as men ready to give evidence and certificates in favour of either side of any question for a suitable fee; and envenoms his sarcasms by quoting the memorable declaration of Chief Justice Dallas, on the trial as to the cause of the fire in Severn and King's sugar-house, when the Chemists of the metropolis, banded and pitched against each other like two troops of prize-fighters, swore point-blank to opposite results in like experiments: "These two days are not days of triumph, but days of humiliation for science." It must be owned, that some professional men are too careless of their reputation in this respect, and grant certificates upon very slender and often erroneous grounds. Two attestations of this kind have been the primary causes of all the annoyance in the present case; and have, in conjunction with another report, equally incorrect, though not *obtruded* upon the guardians of the revenue, placed it in no little jeopardy. For had I not stood firm in the imminent deadly breach, at the risk of my professional reputation—had I given way, as most men would have done in my situation to such authoritative counter-attestations from two of the most popular Professors of Chemistry in London, the consequences to the revenue would have been very disastrous. Henceforth a flood of alcohol would have been poured into the markets of the United Kingdom, under the mask of naphtha, from every foreign state where it is made, duty free, and also from illicit stills at home, to the great defalcation of the spirit-duties; for who would have dared to shut the sluices again, after their systematic demolition by scientific sappers, sanctioned by the Board of Customs?

One of these Professors has, indeed, been recently constrained by weighty facts, which I repeatedly urged upon him, to repeat

his analysis, in conjunction with a chemical friend, and to acknowledge his error, but with certain sophistical reservations. The other may, for aught I know, have died to his opinion; but he has made to me at least, the only *individual* aggrieved, no sign of repentance. Since the matter, therefore, still remains in a questionable shape, and since a dispute purely chemical cannot be referred for decision to the Hon. Commissioners of Customs, however well qualified they may be for discharging their legitimate functions, it must of necessity be laid before the chemical world at large, through the medium of the press. To that tribunal I cheerfully appeal, conscious of the justness of my cause, and of having previously proffered, but in vain, every courteous method of persuasion, conviction, and even demonstration, towards my brother professors. Hitherto it has been customary for men of science to receive the *positive* results of observation and experiment obtained by persons of acknowledged probity and experience, as philosophical facts, before which all *negative* surmises were held of no account. Chemistry is merely a record of such facts, collected from thousands of different hands, arranged in a certain order. Were our two Professors to limit their lectures or their class-books, to their own discoveries, what a poor figure would they respectively cut? Now, since they admit the deductions of other observers, and some of mine, published long ago among the rest, why deny the reality of my positive results, as they have both done, in the present case, with regard to the production of sulphuric ether from the contraband liquor placed in all our hands for examination? This denial is not more a breach of common courtesy, than it is of inductive science; for *ether* is too characteristic a substance to be mistaken for any thing else, and it is produceable from alcohol alone. Should others fail in making ether out of the same liquor, their failure can prove nothing but their want of science or skill; surely not the absence of a body already obtained in very measurable quantity and quality.

13, Charlotte Street, Bedford Square,  
April 20th, 1843.

# RESEARCHES

ON

## WOOD-SPIRIT AND VINOUS-SPIRIT.

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*"Articles are imported under the name of Pyroligneous Ether, Spirit, &c., which are most suspiciously identical with Alcohol, and which, if not closely examined, may lead to serious frauds upon the revenue. Strong Alcohol, disguised as to smell and taste, as in those respects to resemble Pyroxylic Spirit, has already been found in the market."*

Brande's Manual of Chemistry, London, 1836, p. 1125, foot note.

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A CARGO of eighteen casks was entered on the 22d and 30th of September, 1842, as naphtha, in the Custom-house, Liverpool, by Messrs. Tennants, Clow and Co., merchants there, at the valuation in the whole of £50, with an additional 10 per cent. As some doubts were entertained of its being genuine naphtha it was not delivered, but referred to the consideration of the Board of Customs in London. The importers, being apprised of this circumstance, applied to the Board, declaring, "ours is *bond fide* such naphtha as contemplated by your Honours." This memorial is dated 17th October, 1842.

After due deliberation, a sample bottle of the naphtha was ordered by the Board to be sent up to them from Liverpool, which they forwarded to me for analysis; and on the 22d of November, after a careful examination of its contents, I gave in the following report:

"The liquor in the bottle is wrongly called naphtha. It is crude pyroligneous acid, or crude vinegar distilled from wood; but is so weak in acid that 100 parts of it contain only one and two-tenths of real acid, whereas ordinary pyroligneous acid contains from five to seven per cent. But this weakness in acid proceeds from its being mixed with a large proportion of alcohol or strong whisky—a circumstance which is betrayed by the specific gravity of the said liquid, which is much less than water, being only 0.942 to water, 1000; whereas wood-vinegar, in the crude state of pyroligneous acid, is from 1.012 to 1.025 specific gravity, as found in commerce. When the said acid liquor you sent me is neutralized with quicklime and distilled, it affords 70 per cent. of alcohol, of specific gravity 0.878, at 60 Fahr., which is 30 per

cent. above spirit-proof.\* Hence 100 measures (gallons, for example) of this false naphtha contain the equivalent in spirits of 91 gallons proof strength. The spirits, thus distilled, may be rendered quite palatable by rectification with potash, so as to be fit for making English gin. The cargo of naphtha, of which said bottle is a sample, is, therefore, a fraudulent importation of spirits under the mask of pyroligneous acid.

"It is upwards of a year since I drew the attention of one of the officers of the customs to the probability, that when pyroligneous acid or naphtha was imported from foreign countries, it was for the purpose of defrauding the revenue, as now proved.

"ANDREW URE."

"To Mr. ROBINS, Clerk to the Landing-surveyors,  
Custom-house, London."

In consequence of this report, the Honourable Commissioners ordered "the goods to be detained for being entered under a false denomination;" assigning as grounds for this detention, the reasons stated in my report.

The following memorial was presented to the Collector and Comptroller of the Customs, Liverpool, on the 12th December, 1842, a fortnight after the tenor of my report was made known to them:

"With reference to our application to the Board of Customs, touching a parcel of naphtha which we imported by the 'Countess of Arran,' and which their honours have ordered to be confiscated on the allegation 'that it contains pyroligneous acid and mixed with whisky largely, and capable of being made into palatable English gin by rectification with potash,'—

"We beg to state, that in addition to the contrary result certified by the Apothecaries' Hall here, we have since obtained the analysis of the *first Chemist in this kingdom, Professor Graham of the London University*, who positively certifies that it is *not* convertible into gin by potash or by any other process; that it is not alcohol (of ardent spirit); that it is *not* separable from the naphtha, whatever *small* degree of alcohol may be in it, and that it contains NO pyroligneous acid, as alleged.†

"We pray you will be pleased to move their honours to grant that our invoice, advice, and Apothecaries' Hall certificate, may be returned to us, with a view to our deciding what further steps may be requisite for us to take in this matter.

"(Signed) TENNANTS, CLOW AND Co."

\* Thirty-one per cent. above proof by Gutteridge's tables. I operated here upon a portion only of the bottle, and have somewhat overrated the spirit; but it was one of the strongest sample bottles. See afterwards.

† The words printed in italics have one line drawn under them in the copy, and that in capital letters, has a double line drawn under it.

The next step they immediately took was the following memorial :

“ TO THE RIGHT HON. THE LORDS OF THE COMMITTEE OF THE PRIVY COUNCIL FOR TRADE AND PLANTATIONS.

“ MY LORDS,

“ We very respectfully crave your lordship's consideration of the following case, hereby conceiving that your lordship's board is the practical official tribunal for interpreting the real intention of her Majesty's government in the 'new tariff,' as to whether a certain article of trade is or is not a 'spirit,' that is drinkable or rated spirit within its meaning, and so for protecting the fair trader against the unjust confiscations by the revenue authorities of an article which they seize and condemn as a 'spirit,' no doubt conscientiously, but (as we are sure) erroneously, believing it to be one meant by the tariff.

“ By the 'Countess of Arran,' from New York, we imported into Liverpool, and on the 22d and 30th September last entered for duty, 1 B, eighteen barrels of naphtha, an article unenumerated, value altogether £50. We had never before imported such an article; but we read in our book of rates, that by an order of the Hon. Commissioners of Customs, dated 21st January, 1837, it was ruled that 'naphtha, being a fluid distilled from wood, is not deemed a drinkable spirit, and is to pay the *ad valorem* duty, as is rated.'

“ We entered ours accordingly, being at the time quite unaware that the Liverpool officers had systematically seized all fluid entered as naphtha of late,\* and which other cases may or may not contain drinkable spirit. This parcel of ours was seized on the ground that it was a drinkable spirit.†

“ The Hon. Commissioners of Customs have rejected our application for its release on the allegations of an analysis (which we feel constrained to believe must have been either *defective* or *unscientific*) whose alleged results were severally :

“ 1. It appears to be crude pyroligneous acid.

“ 2. Mixed with a large proportion of alcohol or strong whisky.

“ 3. Capable of being rendered quite palatable by rectification with potash, so as to be fit for making English gin.

“ Being ourselves, as merchants often dealing in drysalteries, well aware that the *so-called drinkable* spirit, would be most ruinous poison, not, however, resting on our own judgment, nor yet on the opinion of the practical chemist of the Liverpool

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\* This allegation is quite unfounded.

† This is another unfounded allegation. It was detained "as being entered under a false denomination." Pyroligneous acid and alcohol are surely not naphtha.



Apothecaries' Hall (whose certificate, marked *B*, is annexed, and which, together with our advice, marked *A*, we had submitted to the Customs) we proceeded to take the judgment of Professor Graham, of the University College, London, who is, we believe, one of the *first Chemists in Europe*, his analysis more than corroborated that of the Liverpool Apothecaries' Hall; and it is respectfully enclosed, also marked *C*, and certifies:

"1. That it not merely *appears not*, but actually *does not*, contain any pyroligneous acid, as alleged in the analysis for the Customs.\*

"2. That it is not alcohol, nor convertible by any means whatever into alcohol (of ardent spirit), 'yet from the *impossibility of separating* alcohol and this naphtha, when once mixed,' he cannot declare that this naphtha *does* or does not contain a small quantity of alcohol, but (whether so or not);

"3. 'That this naphtha does not contain any alcohol that could be separated from it, and used in making English gin by distillation from potash, or any other process whatever.'

"Hence, as the first and last results diametrically oppose the corresponding ones of the Customs' analysis, and as Professor Graham's second point also opposes that of the said analysis, which infers a large quantity of strong whisky, whereas the Professor confines the possibility to a small quantity, and even the existence of that must by necessity of nature be *dubious*, but as (unscientifically) it is by no means dubious to us, because we know that it was shipped to us direct from the naphtha manufactory of John Barling, of New York, and that the said manufacturer had *no* direct interest in its sale here; but another party, Mr. Alexander Knox (into whose hands itself never came), as will appear by the endorsing over of the bill of lading advice; and we further know that it would never pay them to mix a superior with an inferior article, to be sold at naphtha prices.

Seeing these London and Liverpool analyses both concur in their *unhesitating* conclusion, that it is not a drinkable spirit, nor convertible into one, we hereby pray that your lordships will be pleased to grant that directions may issue that the said naphtha may be admitted, according to the *intent* of the law, and conformably to its true nature, which may readily be ascertained by further analysis of the samples, if deemed necessary by your lordships.

"We have the honour to be, My Lords,

&c. &c. &c.

"(Signed) TENNANTS, CLOW AND Co."

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\* This denial is a piece of the most astonishing effrontery. The liquor in question, by the sour taste and smell, by test paper, and effervescence with soda crystals, shows itself to be a rank acid. "False as dicars' oaths," said Shakspeare.—Might not another reading be now adopted?

This memorial was fortified by the following affidavit:

"Personally appeared James Cox, one of the firm of Tennants, Clow and Co., merchants of Liverpool—and solemnly and sincerely declared to the truth and good faith of the foregoing representation," &c. &c. Dated 17th December, 1842."

The above memorial was a dexterous manœuvre to mystify the Board of Trade, and thereby to overrule the Board of Customs. It contains, however, three notorious fallacies:

1. The denial of the presence in the liquor of pyroligneous acid, so obvious to any man, woman, or child, who may taste or smell it.

2. The affirmation that it was genuine naphtha; whereas, it will be proved in the sequel to contain no naphtha at all; but to consist entirely of alcohol, or strong whisky and pyroligneous acid, &c.

3. That Mr. John Barling of New York, had no interest in selling to Mr. Alexander Knox the said mixture, which would cost him about sixpence per gallon; whereas, genuine wood-naphtha would have cost him at least six times as much.—*Proh Pudor!*

The whole matter, with the documents, was wisely referred by the Right Hon. the Board of Trade to the Hon. Board of Customs, for their re-consideration. As the responsibility of the detention lay ultimately with me, the Board instructed Mr. Ross, surveyor-general, to invite me to a consultation in his office, at the Custom House, on the 5th of January, when he laid before me the following two certificates:

"University College, December 10, 1842."

"GENTLEMEN,

"I beg to state, that I have examined to-day a sample of crude naphtha, imported by the 'Countess of Arran,' which was forwarded by you. *It contains no pyroligneous acid*, but is the unrectified combustible liquid obtained from the distillation of wood, of which a good deal is imported from Scotland under the name of naphtha or wood-naphtha, but which is not to be confounded with the naphtha from coal-tar. It is named in Chemistry wood-spirit or pyroxylic spirit, and is not alcohol, nor convertible by any means whatever into alcohol (or ardent spirits).

"A small quantity of spirit in naphtha is exceedingly difficult of detection, owing to the impossibility of separating alcohol and this naphtha from each other when once mixed. I cannot, therefore, say, whether this naphtha does or does not contain a small quantity of alcohol; but I can declare, that this

naphtha does not contain any alcohol that could be separated from it, and used in making English gin by distillation from potash, or any other process whatever.

“(Signed) THOMAS GRAHAM, F.R.S.,  
“Professor of Chemistry.”

“MESSRS. TENNANTS, CLOW & Co.”

“Liverpool, October 14, 1842.

“GENTLEMEN,

“After a most careful analysis of wood-naphtha, submitted to me by you, for which purpose, I hereby certify, that I found no evidence of the presence of alcoholic spirit, but it consists only of pyroxylic spirit, or wood-naphtha, with the usual impurities of that fluid; the only peculiarity being that it contains an unusually small proportion of these impurities, on which account *the flavour is more agreeable than usual*; but that it is not a drinkable spirit, and could not, in my opinion, by any chemical process be made a drinkable liquid.

“(Signed) DAVID WALDIE,  
“Practical Chemist to the Liverpool  
Apothecaries' Company.”

“To MESSRS. TENNANTS, CLOW, & Co.”

Out of this *most ruinous poison*, as wholesome and as palatable gin has been made as usually flows from the gin-compounding factory of Sir Felix Booth, Bart. Well may the importers say, that the Professor's certificate “more than corroborated that of the Liverpool Apothecaries' Hall;” for Mr. Waldie shirks entirely the pyroligneous acid, so “gross, open, palpable,” by its rank sour smell and taste, independently of all chemical tests. The Professor's denial of its presence is an unprecedented pitch of *moral* courage, to protect his particular friends and clients; a grace beyond the reach of the Chemist's magic art, much too bold, indeed, for the more literal Mr. Waldie. He, honest man, confesses that “the flavour” of the said naphtha is more agreeable than usual, as it truly ought to be, being chiefly spirits of wine.

On my settling in London, in 1830, and resigning the twofold Professorship of Natural Philosophy and Chemistry, which I had held for twenty-five years in Anderson's Institution, Glasgow, Mr. Graham was deservedly elected my successor in the chemical department; and had he availed himself of the opportunities which that appointment afforded for studying the nature of wood-spirit, he would have learned from two eminent manufacturers of it, trustees of the institution, Mr. M'Auslin and Mr. Turnbull, that the rough wood-spirit of the first distillation always contains some pyroligneous acid, but seldom more than one-fifth of the quantity

mixed by Mr. John Barling, of New York, with his Yankee spirits of wine, to compound such a fictitious naphtha, as might do the British Exchequer out of a little of its spare cash, and the British Chemists out of a little of their spare fame. Since cream always contains more or less milk, though milk often contains no cream, as a Londoner knows full well; such are the relations of rough naphtha and pyroligneous acid.

Mr. Ross requested me to reconsider the subject, and to answer these certificates.

Having fortunately reserved the greater portion of the original sample bottle, immediately on my return home, I instituted a series of careful experiments upon it; and on the 7th of January, handed the following report into the Surveyor-general's office:

"In compliance with the request you made me yesterday at our consultation in your office upon the naphtha imported at Liverpool, which I examined on the 22d of November last, by desire of the Hon. Commissioners of Customs, I have now the pleasure to submit to you the following justification of the certificate I then granted, which will serve to refute the counter-certificates since furnished, as you write me, by a Professor and a practical Chemist:—

"When two liquids are equally volatile, as is the case with alcohol and naphtha, or wood-spirit, it is utterly impossible to separate them completely by distillation, or by any direct methods, and this fact is no doubt well known to the compounder of this spurious naphtha. Surely no man, even moderately versant in Chemistry, would presume to deny the existence of alcohol in the said naphtha, because, forsooth, the two fluids are inseparable by distillation. In like manner, when lead and tin are combined, as in solder, it is impossible to separate them by fusion, because they melt together; but they may however be most easily parted by the action of nitric acid, which converts the tin into an insoluble oxide, and the lead into a soluble salt, and then the two metals may be perfectly separated by mere washing with water, and the quantity of each exactly ascertained, from the known composition of tin oxide and nitrate of lead.

"Thus, also, when alcohol and naphtha are mixed, we must have recourse to an indirect but a quite accurate method of parting them, and estimating the proportion of each in the mixture. In the present case, however, that is hardly necessary, since, on rectifying the spurious naphtha by distillation with quicklime, I could distinguish plainly, by the taste and smell, the presence of alcohol in very large proportion in the purified spirit.

"1. When alcohol of from fifty to sixty per cent. over-proof is mixed with its own weight of sulphuric acid, and properly dis-

tilled, it affords the fragrant liquid well known by the name of ether or sulphuric ether, and when the distillation is continued too long, the residuum in the retort becomes black, thick, and finally froths up with such impetuosity, as to be projected out of the vessel, though this be of fifty times the capacity required by the liquid before its intumescence. The process must, therefore, be well watched, and the heat withdrawn, some time before this phenomenon occurs.

"100 parts of absolutely pure alcohol yield 80.6 parts of ether, by losing merely 19.4 parts of the water combined in the elements of alcohol. See *Liebig's Organic Chemistry*, i., p. 315.

"2. When wood-spirit (wood-naphtha) of the same strength is treated in like manner, and distilled along with sulphuric acid, it affords not a LIQUID, but an AERIFORM product. 'Methylic ether,' says Professor Liebig, 'is prepared by distilling a mixture of equal volumes of concentrated sulphuric acid and wood-spirit. The gas which is disengaged, is to be passed first through milk of lime, and then through several tubulated bottles filled with water. This compound is a colourless gas, possessed of an agreeable ethereous odour. A cold of  $16^{\circ}$  below zero, of the centigrade scale ( $29^{\circ}$  Fahr., below the freezing point of water) does not render it liquid.'—*Chimie Organique*, vol. i. p. 540.

"Berzelius says, 'Oxide of methyle or lignous ether (made as above described) is a gas which does not condense in the receiver, but which should be collected over mercury. It is a colourless gas, which does not condense at  $16^{\circ}$  under  $0^{\circ}$  cent. As the operation of distilling the mixture of wood-spirit and sulphuric acid advances, the mixture becomes yellow, brown, and at last black, but without thickening or frothing up, as happens when alcohol is treated in the same manner.'—*Traité de Chimie*, vol. iii. p. 403, of the French translation by Valerius, Brussels, 1841.

"3. I rectified the said naphtha by repeated distillations; first, by itself to separate the pyroligneous acid (which was obtained in very measurable quantity), and then with quicklime. The volatile spirit thus procured had a specific gravity of 0.839, and resembled alcohol more than naphtha. I then treated it, as above prescribed, with sulphuric acid, when it yielded a fine fragrant LIQUID sulphuric ether, and nearly in as large a quantity as the same volume of alcohol could have done. A very little lignous or methylic ethereous gas also appeared, and passed off through the water of the safety-tube of the receiver. Three fluid ounces nearly of ether were obtained. On continuing the heat, after the receiver was removed, the materials in the retort on the sand-bath became thick, black, frothed up, and were projected out of the vessel with great force. Thus, by the product of fine liquid ether, and the intu-

mescence in the retort, two infallible proofs of abundance of alcohol in the said naphtha are obtained—proofs which will be recognised in every chemical court in Christendom.

“Should you wish me to determine the proportions of each ingredient, please to send me another bottle of the naphtha, and I shall ascertain this point also upon the data stated above.

“It is my opinion that the contraband article in question will make as good ether as the best spirits of wine, because the minute wood-spirit or pyrolignous portion flies off in the form of a gas during the etherification. Hence its clandestine importation, under the false colours of a spurious chemistry, would prove a serious detriment to the spirit revenue, as well as to the honest distiller, rectifier, and manufacturing chemist.

“Finally, I have analyzed the pyroligneous acid residuum of the first distillation of the said naphtha, conducted by the heat of a water-bath, and I find that four fluid ounces of it saturate with lively effervescence as much carbonate of potash as two fluid ounces of ordinary vinegar, of five per cent. of real acetic acid, could have done. Here is, therefore abundant evidence of acid, notwithstanding the Professor's counter-certificate.

“(Signed) ANDREW URE.”

“To A. Ross, Esq., Surveyor-general of H.M. Customs.”

I now considered the matter to be put beyond all doubt; the production of ether being an infallible proof that the spirit was alcohol, and not naphtha: but on the 18th of February, I was summoned by a note to pay Mr. Ross another visit at the custom-house. On repairing thither, he laid before me the following two certificates:

“*Royal Mint, February 2, 1843.*

“SIR,

“I beg to acquaint you, for the information of the Commissioners of Customs, that in compliance with their wishes, I have carefully examined the sample of wood-naphtha forwarded to me with your note of Saturday last; and that, in my opinion, it is not mixed with alcohol or spirits of wine.

“It is a matter of great difficulty to determine the entire absence of minute quantities of alcohol in wood-spirit; but the result of my experiments upon the present sample induces me to believe, that if there be any alcohol in it, the quantity is at all events very small, and not such as to admit of its being again separated for any fraudulent purpose; and I presume there can be no other temptation for the addition of alcohol in these cases.

“If you think it worth while, I can send you the specimens of the pure wood-spirit which I have extracted from your sample,

and which have none of the characters indicating the presence of alcohol.

"I remain, Sir, your faithful Servant,

"(Signed) WILLIAM THOMAS BRANDE.

"My charge on the present occasion is one guinea."

*"Royal Mint, February 10, 1843."*

"SIR,

"I beg to acknowledge the receipt of your letter of this date, enclosing a copy of Dr. Ure's Report [of 7th January], and adverting to the discrepancy between our opinions respecting the sample of wood-spirit lately reported upon by me, and the consequent dilemma in which the Board of Customs is placed. I request you will assure the Commissioners that I did not found my opinion upon the mere endeavour to separate alcohol by distillation, but upon the following experiments:

"1st. I distilled a portion of the sample, and separately collected the first, second, and third portions, which passed over, in none of which could I discern any distinct proofs of the presence of alcohol.

"2dly. I rectified portions of the sample over lime and animal charcoal, and the products were such as might be expected from wood-spirit, and afforded no evidence of the presence of any tangible quantity of alcohol.

"3d. I mixed a portion of the sample with sulphuric acid, and heated the mixture in a retort connected with the pneumatic apparatus. I obtained none of the ethereal products of alcohol, nor could I procure any olefiant gas.

"Under all these circumstances, I thought and still think myself justified in making the report which I had the honour to transmit to the custom-house on the 2d instant. Should it be the wish of the Commissioners, I will carefully repeat the experiments I have described, and subject the sample, *if possible*, to more rigid examination. But, on the whole, I would venture to suggest the propriety of submitting the question to some third chemical authority.

"I have the honour to be, Sir, your obedient Servant,

"(Signed) WILLIAM THOMAS BRANDE.

"To A. Ross, Esq., Surveyor-general, Custom-house."

This second certificate of Professor Brande is a most extraordinary document. Because he cannot make ether and olefiant gas with the spirit of the said naphtha, he does not allow that I had made them, though my report of the detailed statement of facts, as to my producing ether, was in his hands. Seeing that he and I had been on terms of friendly correspondence for a quarter of a century, and that I had contributed to the Journal of Science, edited by him, many chemical researches without my probity

having been ever called in question, he might have had the good feeling to tell me of his want of success in making ether out of the Liverpool spirit, and to have asked a sight of mine. But he has taken another course, and he must abide by the consequence. With half a pint of the said liquor put into his hands, I shall engage to make ether and olefiant gas, and other truly alcoholic products.

To prevent all shirking of the question or subterfuge, by a pretended difference of the liquor in the different puncheons, I requested Mr. Ross to procure for me from Liverpool a sample from each puncheon, and to direct an officer there to test the liquor in each of them with a slip of blue litmus paper which I supplied for the purpose.

On the 25th of February, a letter came to me from Mr. Fanning, surveyor-general, enclosing eighteen slips of litmus paper, all brightly reddened, along with a box containing eighteen bottles full of the said naphtha, having the corks sealed with the custom-house arms.

On Monday, the 27th, I opened the chest and uncorked the bottles in the presence of Mr. Scanlan, whom I had invited to act as witness and assistant to me in the chemical researches upon the liquor in debate. It was found to be of the very same nature in all the bottles, and exactly like my former sample, and like a sample in a five-ounce phial, which Professor Graham had given me the day before. In all of them it had a sour empyreumatic smell, an acidulous taste, reddened litmus, effervesced with carbonate of soda, and had a specific gravity of about 0.942. After being diligently occupied with experiments on the said liquor for three weeks, we then delivered in the following report :

*" 13, Charlotte Street, Bedford Square, March 20, 1843.*

*" TO THE SURVEYORS-GENERAL OF H. M. CUSTOMS.*

*" SIRS,*

*" I have perused with feelings of astonishment, and sorrow, the two reports of Professor Brande, and the certificate of Professor Graham, concerning the liquor imported under the misnomer naphtha, from New York, in the 'Countess of Arran,' which importation is detained by the customs at Liverpool, in consequence of the report of my analysis of the 22d of November, 1842, confirmed by my second examination and detailed report of January 7th, 1843. I found the said liquor to be alcohol or spirits of wine, disguised by the admixture of pyroligneous acid or crude wood vinegar. These two Chemists, and also Mr. Waldie, of the Apothecaries' Hall, Liverpool, on the contrary, declare it to be genuine wood naphtha, that is, wood-spirit or pyroxylic spirit, and not to be alcohol ; or at least to contain so little alcohol, that this is not to be recognised or identified by*



chemical tests, or capable of being applied to the peculiar uses of alcohol.

"Such pseudo-chemistry, as I shall expose in the present report, is most culpable and dangerous, as it tends to cloak a monstrous brood of frauds upon the public revenue, one of the main causes of the necessity of imposing the income-tax.

"Before commencing the series of experiments about to be described, which have occupied me almost incessantly during the three preceding weeks, I called on my near neighbour, Professor Graham, mentioned the awkward discrepancy between his report upon the Liverpool 'naphtha' and mine, which, I said, was discreditable to our common science, and I courteously invited him to attend in my laboratory during the investigation about to take place; but he declined the invitation on the score of business, though he gave me a phial containing five fluid ounces, of liquor, out of the sample bottle, which he had examined and reported upon, at the instance of the importers at Liverpool. This sample I have examined, and find it to be quite analogous to the other samples sent to me by you.\*

"As the accuracy of my two previous reports to you, as also of the truth of my averment as to the production of ether and other alcoholic compounds from the said naphtha, have been controverted very flatly, it became necessary for me, in conducting the

\* The denial of pyroligneous acid, by Professor Graham, at first led me to suspect that there were great differences in the said naphtha in the different barrels or puncheons at Liverpool, and therefore I wrote to the Professor, on the 15th February, stating that suspicion, and requesting a small portion in a phial of his sample bottle. But he felt bound, by fidelity to his clients, to refuse it; he however informed me, in a note, that he had obtained "sulphuric ether, or *what may be taken as such*, in small quantity from English (Lancashire) made naphtha above suspicion of adulteration."

"Do you see yonder cloud, that's almost in shape of a camel? By the mass, and 'tis like a camel, indeed. Methinks, it is like a weazel. It is back'd like a weazel. Or like a whale. Very like a whale."—*Hamlet*.

If Professor Graham shall from genuine wood-spirit, made by Messrs. Hill of Deptford, or any other honest manufacturer, produce a pint of sulphuric ether, possessed of its well known refreshing fragrance, boiling point under 100° Fah., and specific gravity of 0.742, as I have done from the naphtha of his "particular friends" at Liverpool, I shall then allow that their eulogy of him, as the first British Chemist, and one of the first Chemists in Europe, is well merited. Till then, they will permit me to remind them that such Chemists as Professors Faraday, Berzelius, Gay Lussac, Thenard, Mitscherlich, Liebig, Gmelin, Dumas, Pelouze, &c. &c. are in existence, with each of whose names, such important discoveries are associated, as have changed the main features of the science, and constitute a legacy of invaluable truths to all future generations. Nothing will give me greater delight than to see Professor Graham produce chemical researches, entitling his name to be emblazoned in that bright galaxy. But, as an older, if not a better, Chemist, let me caution him against such precipitancy and dogmatism, as he has displayed in his naphtha certificate.

elaborate researches, subservient to the present report, to call in the aid of a gentleman, who should be at once an unimpeachable witness as to my results, and a skilful coadjutor in the operations: and I have had the good fortune to procure the services of Mr. Scanlan, well known to the chemical world, as being the author of the only discovery of consequence made regarding naphtha by any British chemist. He has had, moreover, much experience in the manufacture of ether, and in the rectification of alcohol and wood-naphtha upon the commercial scale.

"As Professor Graham had affirmed, in his certificate granted for the defence of the importers, that the said liquor 'contains no pyroligneous acid;' while the sample sent to me by you, in November last, contains a great deal, I requested Mr. Ross, surveyor-general, to cause the officers at Liverpool to test the contents of the several puncheons in their custody, with blue litmus paper, which I forwarded to him. This was accordingly done upon the eighteen puncheons; and it proved by the bright reddening of the said litmus papers, that the liquor of the whole was strongly acidulous—like the original sample. Mr. Ross also sent me, on the 25th of February, a box containing eighteen sample bottlesful of the said eighteen puncheons, sealed with the custom-house seal, and marked 1, 2, to 18, with I.B. under each number.

"On Monday morning, Mr. Scanlan and I commenced our analytical operations. We found all the sample bottles to contain a liquor, apparently the same, having a specific gravity of 0.944 in general—one was 0.942, and three or four were 0.948. This trifling difference arose from slight variations in the quantity of pyroligneous acid which had been added originally to the alcohol for the purpose of disguising it. They all had the sour smell of crude vinegar, and reddened blue litmus paper very strongly.

"We subjected half a gallon measure, taken from five of the bottles indiscriminately to distillation by the heat of a water-bath, as a preliminary experiment, and obtained a spirit of specific gravity 0.901, or 14.67 over-proof, while an acidulous residuum was found in the still, which was saturated with effervescence by crystals of soda, and indicated one per cent. of real acetic acid in the original liquor, equivalent to twenty per cent. of excise proof vinegar. The above experiment furnished eighty-one per cent. of proof spirit out of the gallon. Some of this spirit was rectified along with quicklime in a glass retort, by the heat of a water-bath, whereby its specific gravity became 0.832, or 58.63 over-proof.

"A portion of this spirit was mixed with its own weight of sulphuric acid (oil of vitriol), and distilled with proper precautions by the heat of a sand-bath, when there was obtained an agreeable smelling ether, in about the same quantity as pure alcohol, of the same strength, would have yielded. This fluid, on being

rectified in the usual way, afforded a fine ether, of specific gravity 0.752; a lightness perfectly decisive of the perfection of the ether, and consequently of the spirit from which it was formed, being nothing else than alcohol.

"Having made these incipient trials, we proceeded to operate on a larger scale, and distilled a gallon of the Liverpool liquor in a still mounted with a rectifying apparatus of my own invention. The pyroligneous acid was saturated beforehand with quicklime, and then the clear filtered liquor was subjected to distillation over a naked fire. The spirit which came over was again rectified with more quicklime, in a glass apparatus, by the heat of a water-bath, when it came over of a specific gravity 0.8268, or 61 over-proof. Spirit of this gravity being well adapted to making ether, a proper proportion of it was taken along with sulphuric acid, and submitted to the process of etherification in Bouillay's continuous method, as described in my Dictionary of Arts, p. 442. Ether came over most abundantly through Liebig's glass condenser, into a glass receiver, furnished with a safety-valve. The ether was characterized by its peculiar striæ or lines of fluid down the sides of the globular receiver, as also by its cool refreshing fragrance. No less than twenty-six fluid-ounces, apothecaries' measure, were obtained of an ethereous liquid, of specific gravity 0.787, which, on rectification, became of specific gravity 0.742, boiled under 100° (Fahr.), and amounted to fully twenty ounces measure, being a quantity about as great as the same quantity of alcohol of the purest kind would have yielded. This ether is lighter than the best standard ether of the Pharmacopœia, sold at the Apothecaries' Hall, London, therefore finer, and certainly as fragrant, and fully more volatile.

"This sample of ether, of about a pint measure, was examined at my request, by Mr. Morson, of Southampton Row, and Mr. Bell, of Oxford Street, both competent judges of the article, who found its specific gravity to be 0.742, and pronounced it to possess all the physical properties of sulphuric ether.

"The sequel of the ether distillation furnished the usual liquid products of the etherification of alcohol along with olefiant gas in great profusion, characterized by its burning with a white flame, like that of wax candles, and by its being condensed on admixture with chlorine gas into chloride of carbon, the oily looking liquid from which it derives its familiar name.

"I have found that when ten parts of wood-naphtha are mixed with ninety parts of alcohol, each of moderate strength, and the mixture is treated with sulphuric acid as above, it does not afford any good genuine ether, but a peculiarly pungent offensive fluid, proving that the spirit drawn out of the Liverpool naphtha must contain little or no real wood-naphtha, but that it owes its peculiar taste and flavour to the pyrogenous oil of the wood vinegar,

of which a few drops suffice to contaminate a gallon of good sweet alcohol.

"Sweet spirit of nitre is another product of alcohol, consumed in vast quantities in the United Kingdom, and which cannot be formed at all with wood-spirit naphtha. Mr. Scanlan and I followed the prescription of the Pharmacopœia, and obtained the full quantity of sweet spirit of nitre from the rectified Liverpool liquor, just as if we had used a like proportion of alcohol. The sp. gr. of this spirit was only  $0.842=53.7$  per cent. over-proof, while that of the commercial article is  $0.850=49.1$  over-proof.

"We have also prepared a good drinkable gin, which persons accustomed to that beverage have relished very much. It was made with the Liverpool naphtha rectified with potash, as is customary in the compounding of cordials. Samples of the ether, sweet spirit of nitre, and the gin accompany this report.

"I have submitted a sample of the naphtha so rectified to Mr. Bowerbank, one of the most extensive and skilful rectifiers in London; and I take leave to hand in his report herewith, which I consider also a conclusive evidence of the said naphtha being alcohol.

"Having thus proved the alcoholic nature of the article, Mr. Scanlan and I next made a careful experiment to determine its exact amount, and that of the pyroligneous acid with which it was disguised. We distilled a gallon of the Liverpool liquor previously neutralized with lime, and obtained at one operation, by means of my rectifier, a spirit  $37.46$  per cent. over proof, equivalent in quantity to eight-tenths of the whole gallon in proof spirit, or  $80$  per cent. The residuary liquid, pyrolignite of lime, was decomposed into acetate of soda by crystals of soda, of which  $3000$  grains were required, indicating  $1083$  grains of real acetic acid, equivalent to about  $45\text{oz}$  measure of vinegar, excise proof, or thirty per cent. of the original liquor. Thus the Liverpool pretended naphtha consists of seventy parts alcohol,  $14.3$  over-proof, and thirty of pyroligneous acid.

"I now proceed to describe the researches we made into the properties of the several kinds of wood-naphtha now in the market, with the view of ascertaining the best criteria for distinguishing that fluid from alcohol, and consequently for discovering directly whether any sample of naphtha be illicitly compounded with alcohol, or be genuine.

"With this view, I procured from Messrs. Hill of Deptford, whose chemical works I am well acquainted with, a quantity of their rectified wood-naphtha, and also of the rough naphtha as first drawn off by distillation from the pyroligneous acid of their own manufacture.

"We rectified in my still, a gallon of their genuine rough naphtha, and found it to exhibit all the phenomena characteristic of this fluid; viz., boiling at a temperature fully twenty degrees below

that at which alcohol-wash of the same gravity boils, and exhaling the peculiar smelling vapour of aldehyde, most offensive to the nose, and causing the eyes to redden and to weep. When thus distilled, it agreed in its properties with their rectified wood-naphtha. The fluid is colourless, has a peculiar, somewhat offensive odour, exhales, at a moderate warmth, a vapour very painful to the eyes, and, therefore, much dreaded by the hatters, who used to employ it in large quantities for dissolving their so-called gums, or shellac and sandarac. Hence there is a very strong temptation to introduce in its stead smuggled alcohol, slightly disguised, which does not injure the eyes, and is, moreover, a far better solvent of the gums. The pyroxylic spirit of Messrs. Hill is almost the only one that I have been able to meet with on sale in this country, which I think to be truly genuine. Other samples consist, more or less, of alcohol, illicitly introduced to the great injury of the revenue.

"Genuine wood-spirit has the following distinctive characters :

1. When rectified naphtha, of specific gravity of 0.870, such as Messrs. Hill send out for sale, is distilled along with a large quantity of unslaked powdered quicklime, in a retort plunged into boiling water, the spirit comes over with its gravity unchanged ; whereas, if genuine alcohol, or the spirit from the Liverpool naphtha, be distilled in the same way, each of these is alike concentrated, so as to be obtained nearly free from water, and of a gravity under 0.800, or 70 per cent. over-proof, and of the temperature 60° (Fahr.). Here, then, is a most remarkable difference between alcohol and wood-spirit ; one which of itself demonstrates the Liverpool liquor to be alcohol, and not naphtha ; for did it contain even five per cent. of naphtha at the original dilution of the liquor, it could not be concentrated by the heat of boiling water with quicklime to the above low gravity. Wood-spirit, thus, seems to possess a greater affinity for water than alcohol—a fact, of which another evidence will be presently adduced.

2. When alcohol is reduced with water, the mixture undergoes a condensation of volume, so that 100 gallons of strong alcohol mixed with 50 gallons of water, do not occupy the space of 150 gallons, but a less space, proportional in a certain degree to the strength of the alcohol. Upon this fact, the excise tables of alcohol are constructed. Thus, when alcohol, of specific gravity of 0.832, or 58.6 over-proof, is to be reduced to proof, or 0.920, 100 parts of it in volume are to be diluted with water till the mixture at 62° Fahr. occupies the space of 158.6 measures.

"The spirit from the Liverpool liquor agrees exactly with alcohol in this respect, but both differ from wood-naphtha, which suffers a greater penetration of parts, and condensation of volume by dilution with water, so that 100 parts of specific gravity 0.832, made to occupy 158.6 measures, by the addition of

water, form a mixture of specific gravity 0.927 or 0.928, at 62° Fahr. Even the genuine naphtha of specific gravity 0.870 or 36.12 over-proof, reduced with water till 100 measures become 136.12, has a specific gravity of 0.927; whereas alcohol and the Liverpool spirit so treated, have the specific gravity of 0.920, or excise spirit proof.

"3. The boiling temperatures of alcohol and genuine wood-spirit are remarkably different, and afford therefore excellent criteria for distinguishing the two fluids. Hills' naphtha of 0.870 specific gravity, boils at 144° Fahr. when heated in a small flask or matrass by means of a water-bath. If it be concentrated to the strength corresponding to specific gravity 0.832, it boils at 140° Fahr. Alcohol of specific gravity 0.870, boils in the same circumstances at 180°, and of specific gravity 0.832, at 171°. 5' Fahr. The spirit from the Liverpool liquor agrees with alcohol in its boiling points at the several degrees of specific gravity, but differs entirely from naphtha in this most characteristic feature. If ten per cent. of naphtha be mixed with alcohol, each of specific gravity 0.870, the boiling point of the alcohol is lowered at least six degrees of Fahrenheit's scale. Upon this physical principle, it is clearly demonstrable that the spirit in the Liverpool liquor does not contain five per cent. of wood-naphtha.

"The spurious naphthas in the market are characterized by two features; first, their low specific gravity; second, their high boiling points. Some of them have a gravity of only 0.822, others of 0.827. Now, as it is impossible to concentrate real wood-spirit to this pitch, by any ordinary manufacturing means, while alcohol may be without much difficulty so concentrated, a suspicion naturally arises of the illicit introduction of alcohol into a liquid sold at a price sixty per cent. at least under that of alcohol. This suspicion becomes a certainty on referring to the boiling points and other means that have occurred to me. The temperature at which these very *light* naphthas boil, is *higher* by at least 8° Fahr. than that of the much heavier and more watery naphtha of Messrs. Hill. One naphtha of specific gravity of 0.8216 boils at 152°, while Hills' genuine wood-spirit of 0.832 boils at 140° Fahr. By compounding alcohol and genuine naphtha, fluids are formed with boiling points like the above spurious or fraudulent naphthas.

"4. When genuine naphtha is treated with its own *weight* of sulphuric acid, as in the process of etherification, the phenomena and products are quite different from those with alcohol and sulphuric acid. White fumes are exhaled most abundantly, while a gas is disengaged that burns with a faint blue flame. An acidulous liquor is found in the receiver, which being neutralized with potash, and redistilled, affords a liquid of specific gravity 0.911, possessed of a peculiar pungent spicy odour, and resembling coal-oil

in being immiscible with water. Here are sufficient proofs that real wood-spirit can furnish with sulphuric acid nothing in any respect resembling ether.

“(Signed)      ANDREW URE,  
                         “MORRIS SCANLAN.”

In the course of the above and other elaborate researches, unnecessary to be detailed here, I had the good fortune to contrive a mode of solving the following rather puzzling problem — one of great consequence in this fiscal question :

*Given a mixture of wood-naphtha and alcohol, each of the same specific gravity or otherwise, and which suffer no change of density by admixture : to determine in the course of twenty minutes the proportion of each.*

The solution of this problem is quite independent of the boiling temperature, which is, indeed, not precise enough to lead to correct results in the present case. It is, in fact, performed without the aid of heat. The following testimonial will satisfy the reader that I know something of the mutual relations of alcohol and wood or pyroxylic spirit. I am not aware that the records of science offer any clue to the solution of this apparent enigma.

“ March 5, 1843.

“ Dr. Ure having stated that he could determine, by a simple and expeditious process, the proportions of spirit of wine and pyroxylic spirit in a mixture of these two fluids, Mr. Morson and I, submitted to him such a mixture, the proportions of which were known only to ourselves. After an absence of twenty minutes his experiment was concluded, and his report, as to the proportions of spirits of wine and pyroxylic spirit, was perfectly correct ; namely, forty parts of the former and sixty of the latter.

“(Signed)      T. REDWOOD.”

This gentleman is the professor of Pharmacy to the PHARMACEUTICAL SOCIETY of Great Britain.

Having terminated for the present the chemical proofs, I shall subjoin some commercial considerations upon the subject. Wood-naphtha is the product of pyroligneous acid solely, from which it is obtainable in the very small proportion of less than one per cent. But that acid is made almost solely for the use of calico-printers, so that where there are no great calico-printing establishments, as there are none in the United States, little or no wood vinegar is prepared. Now the cargo of the present naphtha detained at Liverpool, amounting to about 2000 gallons, would be equivalent to at least 200,000 gallons of pyroligneous acid, a quantity certainly far greater than has been formed there since the days of Elizabeth. Great Britain and France supply the American females with a profusion of printed goods of such price, beauty, and fashion, as to suppress almost entirely their small homely fabrics of the kind. If they cannot

therefore, send us naphtha, which they do not make, and could not make so cheaply as in the works of Swansea and other parts of Wales, they can inundate England with their coarse ardent spirits in the depressed state of their distilleries, at the rate of one shilling per gallon, whereas, naphtha is worth six times that sum; and they can readily procure as much pyroligneous acid as will suffice to give their alcohol such a taste and flavour as to deceive chemists who take their nose for their guide. This is 'the heart of the mystery.'

The following are three other certificates, addressed to the Custom-house, upon the said naphtha. No comments need be made upon their errors after the preceding report :

" *Liverpool, September 12th, 1842.*"

" The dark coloured spirit submitted for examination, contains :

" Absolute alcohol . . . . .	78.0
Water . . . . .	19.5
Vegetable tar . . . . .	1.2
Empyreumatic spirit, resembling kreosote	1.3

" I consider that the article examined would yield by careful distillation, at a temperature not exceeding 180° Fahr., 97½ per cent. of alcoholic spirit, 54° over-proof, comparatively free from the essential oil of tar; and I have no hesitation in saying, that by redistillation (*in vacuo*) a spirit might be obtained applicable to all purposes for which spirits of wine is used.

" GEORGE TAYLOR."

" 100, *Upper Thames Street, 23d Sept. 1842.*"

" SIR,

" The liquid appears to us a spirit, but whether from grain or sugar we are unable to determine; it is, however, mixed with coal-tar naphtha, which we consider would prevent its employment for all the purposes of spirits of wine, on account of the flavour imparted by the coal-tar naphtha.

" We are, your obedient Servants,

" DAVY MACKMURDO, & Co.

" To — SHAW, Esq., *Landing-Surveyors' Office.*"

" *Crown Street, 8th October, 1842.*

" The sample of naphtha shown us to-day, and represented as imported from Rotterdam\*, we firmly believe to be common grain-spirit, the manufacture of that country, coloured and mixed with tar: it tries 55.1 per cent. over-proof.

" The import of this article, if allowed at a less duty than paid on spirit by the English distiller, will have an injurious effect on the spirits of wine trade, and consequently also interfere with the revenue.

" ROBERT PRESTON."

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\* It came from New York.



*Report upon a sample of Naphtha imported from Havre in the "James Watt," sent to Dr. Ure for examination by order of the Hon. the Commissioners of Customs, on the 27th March, 1843.*

"SIR,

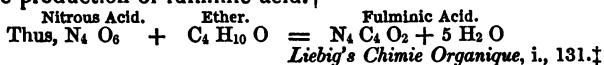
"I have subjected the sample of the said naphtha to an ample series of analytical researches, and I find it to be composed to the amount of at least 95 per cent. of alcohol of specific gravity 0.842, at 60° Fahr., or about 53.7 over-proof. As there has been much controversy of late on the subject of naphtha, I shall, on the present occasion, lay before you, for the satisfaction of the minds of the Hon. Commissioners, the experimental grounds upon which I have formed the above decision.

"1. When this said naphtha is subjected to my new process for determining the proportion of naphtha or wood-spirit (as it is called in chemistry) and alcohol, in a mixture of the two liquids, the resulting indication is upwards of 95 per cent. of alcohol. (The document proving the accuracy of this process was given with my report of the 22d instant.\*)"

"2. The boiling point of the said naphtha is at the commencement so high as 166° Fahr., and it speedily mounts to 170° Fahr., being about 20° higher than the boiling point of genuine wood-spirit, and nearly that of alcohol, or more exactly that of a mixture of ninety-five parts of alcohol and five of wood-spirit.

"3. When the said naphtha is reduced to proof strength by adding water to it according to the excise tables, it acquires the specific gravity of 0.920 very nearly, as alcohol of like strength does when so diluted; whereas, genuine naphtha reduced by the same tables, acquires the density of 0.927, which corresponds to six per cent. under proof; the temperature being taken for the whole at 60° Fahr.

"4. When the said naphtha is applied in the usual way, to the process for making fulminating mercury, along with nitric acid and quicksilver, it exhibits the very singular phenomena which alcohol alone does in that process, while it produces nearly as much fulminate as a like quantity of alcohol could do, and of the best quality. I have ascertained by exact trials that genuine wood-spirit will not make fulminating mercury at all, nor indeed should it do so, for it is clearly demonstrated by the principles of chemistry, that the base of alcohol, which is ether, is indispensable to the production of fulminic acid.†



\* See page 24.

† The spirit from the Liverpool spirit shows itself to be nearly pure alcohol, by affording nearly as much fulminating mercury in the above process, as ordinary alcohol does.

‡ According to Dumas and Peligot (two of the most eminent French

"5. When the said naphtha is mixed in the cold with strong nitric acid, it effervesces, then boils up furiously with disengagement of etherized nitrous gas just as alcohol does; whereas, genuine wood-naphtha thus treated, undergoes no change, except that of assuming a rich ruby tint, but it remains cold and tranquil.

"6. When the said naphtha is mixed with its own weight of sulphuric acid, distilled, and the product rectified, it affords good ether, as also olefiant gas in the sequel of the first distillation. But I have ascertained that alcohol is spoiled for making good ether when it has ten per cent. of wood-spirit mixed with it; therefore this Havre liquor cannot contain at the utmost more than five per cent. of genuine naphtha.

"7. When the said naphtha is diluted with water to about proof, it has more the taste of vinous than of wood-spirits, being nearly free from the burning bitter flavour of the latter.

"8. But by far the nicest criterion for distinguishing alcohol, when disguised with pyrogenous oil, from wood-spirit, is the following: If a teaspoonful of such potash as is used by the spirit-rectifiers, be thrown, in powder, into a little colourless wood-spirit in a wineglass, it will immediately cause it to assume a brown tint; when the same is thrown into alcohol, it causes no change of hue for many hours, and only a faint yellowish tinge in the course of a day; but if the alcohol contain even two per cent. of the wood-spirit, it will acquire a yellowish tint in ten minutes, and a brownish one in half an hour. The spirit rectified from the Liverpool liquor, the certified genuine wood-naphtha of the two professors, stands this test like alcohol, proving, beyond all doubt, that it contains no naphtha at all, but is wholly alcohol. I recommend this experiment to their adoption as an elegant class illustration of the distinction between wine spirit and wood spirit. The Havre naphtha comports itself with the powdered potash, like alcohol mixed with about one-twentieth of its volume of wood spirit.

"Mr. Scanlan first drew the attention of Chemists to the reaction of caustic potash and wood spirit, at the meeting of the British Association at Newcastle. The phenomenon he noticed, was the sudden heat and ebullition produced in the admixture of the two substances; but I have found, on a careful examination of the appearances, that the ebullition takes place only when the wood spirit contains aldehyde, as it often does in the commercial article, because the first and last runnings of the rectifying-still are generally mixed together. I find that the first portion drawn off from the rough naphtha produces this

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Chemists), wood-spirit, treated with nitric acid and nitrate of silver, as for the preparation of fulminate of silver, by means of alcohol, affords, without any peculiar violent re-action, a yellow precipitate, which is a combination of one atom of nitrite of silver with two atoms of formate of silver.

effect in a greater or less degree, but the second and third portions do not. The strength of the spirit is of no consequence here, for I have obtained as violent an ebullition with wood spirit of 0.870, as with one of 0.838; and, at either density, with the second and third fractioned parts, no ebullition at all. Alcohol of 0.840, mixed with powdered potash, rises in temperature from 60° to 150° Fah.; wood spirit from 60° to 165°. In all cases, however, wood spirit is speedily dyed, first yellow and then brown, by powdered potash—and more or less rapidly according to its greater or less proportion in an alcoholic mixture. Hence, by means of nitric acid on the one hand, and caustic potash on the other, the tyro in Chemistry may readily solve the problem which has baffled our two famous professors.

“The above criteria are, in some measure, the results of my own recent investigations of wood-spirit and alcohol. There are others which I could resort to if necessary, but being of a more recondite and scientific character, I shall not use them at present, as I deem those now given quite conclusive as to the contraband nature of the importation by the ‘James Watt,’ from Havre.

“The admission of these pretended foreign naphthas, at the low duty hitherto charged, is most injurious to the spirits revenue, as also to the home manufacture of wood-spirit. Since alcohol is untaxed in France, Belgium, Germany, and America, it can be made in these countries of the above strength for less than two shillings a gallon, and when merely flavoured with wood or coal-naphtha, it is a far more valuable solvent of hatters’ gums, than the genuine wood-spirit, which is so offensive to the workmen, that in many hat factories, alcohol would be preferred were its price only double that of wood-spirit. Indeed, the consumption of alcohol for dissolving hatters’ gums and making varnishes, has been of late years entirely superseded by naphthalized spirits of wine, whether imported from foreign countries, or fraudulently compounded at home. Such naphtha as the present Havre article, will supersede the use of alcohol in the manufactures of varnishes, ethers, sweet spirits of nitre, fulminating mercury, and in other processes in which vast quantities have heretofore been consumed, to the great benefit of the revenue.

“I have the honour to be, &c.

“ANDREW URE.”

13, Charlotte Street, Bedford Square,  
29th March, 1843.

“To C. DOWDING, Esq., Surveyor General of H.M.C.”

Since the fiscal authorities have, by this controversy, had their attention directed to the smuggling of naphthalized alcohol, they have sent me no less than ten further samples for analysis, within the last fortnight. Two of these came from the Customs, and eight from the Excise. The first of the former from Havre de Grace, was a mixture of sixty parts of real wood-spirit, and forty of alcohol, meant no doubt as a puzzle for our professors of Chemistry; the second was alcohol made offensive to the smell and taste by contamination with a very little crude naphthaline, or coal oil, from the gas works. It was the manufacture of some John Barling, in Jersey. The eight samples seized by the Excise, consist entirely of strong alcohol, impregnated more or less with the *dead* coal oil of the coal-tar distillers, a cheap enough mystification, and one well fitted to entrap those professed Chemists, who are so senseless as to be misled by the senses alone. Any one may easily judge, by these examples of smuggling, collected in so brief a space, of the extent to which the spirit duties must have suffered defalcation during the preceding years. Rectifiers in London who were wont to supply the hat manufacturers, varnish-makers, and others, with large quantities of spirits of wine weekly, have for some time past sold little or none. Their occupation's gone.

I shall conclude with a few remarks on the professorial counter-certificates. But first of all let me entreat the reader to remember that this criticism is purely defensive on my part, for Professor Graham's *declaration*, and Professor Brande's second report, were drawn up in direct contradiction of my decision, which had been made in a dispassionate professional manner, at the instance of the Board of Customs. Not only was the accuracy of my experiments flatly belied by both, but their possibility scouted; and even the truth of my averment, with regard to the production of ether, disallowed by Mr. Brande, who, incredulous of my veracity, recommends a third chemist to be consulted, as if Chemistry were a conjectural art, like medicine or law. But the Hon. Commissioners having in the space of ten years, and in the course of many difficult investigations, never found me once in error, did not dismiss me from their employment at his amiable suggestion.

Let the reader also remember, that I am vindicating not merely my own reputation, but the cause of public justice against private fraud, screened by carelessness or unskilfulness, in two of the official judges of such matters.

I am meanwhile conscious of having behaved with proper courtesy towards these two Professors. I called on Mr. Graham the day after I had received the eighteen sample bottles from the Customs; told him that now the means were at hand for putting an end to a difference of opinion between us, disreputable to our science,

and I invited him to come to my laboratory (only five minutes' walk from his own house), in order to witness the researches about to be carried on there by me, in the presence of his acquaintance, Mr. Scanlan. He declined the invitation on the score of business; but said, he would make experiments by himself upon the liquor if I would send him some. This proposal was, in the first place, inadmissible, because the liquor was confided to me by the public for my own investigations; and, in the second place, it was preposterous, because the Professor could get any samples of it he might desire from his particular friends and clients, the importers at Liverpool.

Mr. Brande lived at too great a distance, and being a chemical pluralist, had too many multifarious employments to afford to spend time in my laboratory; but when the researches, above described, were nearly finished, and when the report was in preparation, I invited him, by a friendly note, to come and see the various products of our three weeks' work, which proved beyond a doubt that the liquor was really alcohol, which he had mistaken for wood-spirit or wood-naphtha.

I was solicitous *for the satisfaction of the Board of Customs, but not in the least on my own account*, that he should suffer me to convince him, and that he should then communicate to the Board his acquiescence in my decision. I signified to him, at the same time, that my report was urgently called for by the Surveyor-General, in which I would be under the necessity of exposing in severe terms the errors of his report to the Customs, respecting "a sample of wood-spirit," in case he rejected my amicable invitation, to see the irresistible evidences of its alcoholic nature in my possession.

He replied, "I am surprized at the receipt of your note of this morning's date, expressing your intention, &c. (as above stated).

"My engagements are such that I cannot possibly wait upon you were I so inclined, which, under the threat you hold out, I must candidly tell you I am not, and therefore leave you to exercise your own judgment as to the course you may pursue. At the same time, as I presume from the tenor of your note, you must have been misinformed upon some points of the case, I beg to lay a condensed statement of it before you.

"Towards the end of January, I received a bottle from the Customs, purporting to be 'wood-naphtha supposed to contain spirit,' with a request that I would examine and report upon it. Your name was not mentioned, and of course I was not aware that you had already pronounced upon it; had I been so I should certainly have desired a conference on the subject. I examined it, and reported that it might possibly contain a little alcohol, but not in such quantity as to admit of their separation for fraudulent purposes.

"On the 10th of February, I received a second note from the Customs enclosing your certificate, from which I learned that my report had been submitted to and animadverted upon by you, and that thereupon you had communicated to the Customs the details of your experiments.\*

"I confess that under these circumstances, I was surprized you had not communicated with me upon the subject. I therefore, immediately sent to the Customs the grounds of my opinion, which no doubt have also been submitted to you, and further, I advised that the matter should be referred to a third competent person. I heard nothing more of the matter till last Saturday week, when I found from Mr. Graham, that he had examined the said wood-spirit, and had arrived at the same conclusion with myself.

"I must now leave you to prove my errors, with any degree of severity you think fit. I shall be most happy to confess my error, when I am convinced of it, and as I have retained a portion of the sample sent to me, it will be easy to set the question at rest."

On receiving this strange note, I pleased myself with the hope, that when his *monomania* about my criticising his report, four weeks *before* it had been written, was cured, he would still accept of my renewed invitation to come and see the various alcoholic products of his fancied naphtha, a pint of fine ether among the rest; and I wrote to him immediately with that view, reminding him at the same time of our having maintained a mutual good understanding for twenty-five years. His answer was as follows:—

"Royal Mint, 21st March, 1843.

"MY DEAR SIR,

"I am much obliged by your note of this day's date, and very glad to find that I had completely misunderstood the tenor of your report. I therefore beg at once to withdraw any angry expressions which may have escaped me yesterday, when writing under a misconception.

"As the matter now stands, I really do not see the use of a conference. The only question to be determined, is, whether alcohol, ether, and olefiant gas, can or cannot, be obtained from the sample in my possession, and this I will take care to have ascertained by an unquestionable and unbiassed authority. If I find that I have made a mistake, I will immediately write to

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\* My report bears on its "head and front," very plainly written, the date of the 7th January; his first report upon which he fancied that I had animadverted, is of date 2d February!!!—See pages 13 and 15.

the Customs, and avow it; if not, I have nothing further to suggest, except the impossibility of identity in our respective samples.

“ Believe to remain,

“ Very truly yours,

(Signed) “ WILLIAM THOS. BRANDE.”

“ DR. URE.”

I immediately replied to this note, that there was no room for his surmise about the difference of samples, for I had received a sample bottle from each barrel at Liverpool, and that they were all ascertained to be the same exactly, by Mr. Scanlan and myself. Had Mr. Brande favoured me with a visit of a couple of hours, I should in that time have satisfied him;

1st. That the samples were identical in composition.

2. That they all consisted of alcohol and pyroligneous acid, separable from each other by distillation.

3. That the spirit was really alcohol, and not wood-spirit or wood-naphtha; as by the criteria detailed in pages 26 and 27 of this pamphlet. He declined my third invitation in a civil note, on the score of “the extreme pressure of business.” He concluded notwithstanding with this hackneyed sentiment: “*Fas est et ab hoste doceri.*” As this seemed a rather *malaprop* quotation between friends, I took leave to suggest to him another sentiment, equally trite, but more suitable to the occasion—“*Amicus Plato, sed magis amica veritas.*”

And here our running fire of correspondence ceased for some time. At length, on the evening of the 31st March, I received the following note from Mr. Brande:

“ MY DEAR SIR,

“ I now write to you to acknowledge my error. I submitted my sample to a chemical friend, who on comparing it with genuine pyroxylic spirit, suspected the presence of alcohol, and afterwards obtained it from the so-called wood-spirits. I have also assured myself of the possibility of obtaining alcohol, and of course, ether, from the same spirit. There is, however, as far as I can judge, so small a relative proportion of alcohol, as to render the case, not practically, though certainly, theoretically a fraud upon the revenue. How I came to miss the alcohol in my first examination I cannot tell, unless it is that the pyroxylic products pass over before the sulphuric acid takes effect upon the alcohol, I have written to the Commissioners of Customs this day, informing them of my acquiescence in the existence of alcoholic in the wood-spirit in question.”

In my answer to this note I informed him that I should exhibit proofs in my forthcoming paper upon this controverted subject, that the spirit present in the Liverpool liquor was altogether alcohol—that it certainly did not contain two per cent. of naphtha, and probably none at all. The test of caustic potash (see p. 27), proves the last position to be the true one. I may here state, that I keep in the Custom-House bottles, for the inspection of the curious, numerous specimens of this alcoholized wood vinegar, of which one Chemist affirms "It contains no pyroligneous acid," and which acid, another overlooks entirely in his analysis and reports.

The singular notion of a theoretical fraud deserves a word of comment. Does he fancy that smugglers theorize, or follow blindly the *ignis fatuus* of hypothesis, like a professor of Chemistry? and that they send us merely a little alcohol, which costs them one shilling a gallon, but disguise it with a great deal of wood-spirit, which costs them four times as much? No, truly; smugglers can distinguish better between profitable facts and empty fictions than certain philosophers. A fraudulent theory, though not a very correct expression, may yet be interpreted to be a false hypothesis *stily* fabricated; but a theoretical fraud is, I believe, a perfect novelty both in law and finance. Perhaps, the term might be not unaptly applied to the certificates of the two learned Professors, and here this *conundrum* may be left for the present.

Finally, Nothing can place in a juster point of view, the lamentably low condition of organic chemistry in England, than the fact of two of the most prominent professors of the science in London having proved by formal public declarations, made after deliberate experiments, that they are unable to distinguish alcohol from wood-spirit. Nay, further, they do aver solemnly, that alcohol, merely tainted with pyrogenous oil, is not alcohol; but genuine pyroxylic spirit. What will the chemists of the Continent think of this remarkable ignorance or want of skill? Though, indeed, they must be somewhat prepared for such a phenomenon; since among the thousand brilliant discoveries, made within the last seven years in organic chemistry, not one of any note can be traced to an English professor; several of whom, however, have good incomes, with well appointed laboratories and instruments of research, assigned to them at the public expense for the cultivation of the science; whereas my means are wholly provided at my own private cost.

May I now venture to indulge the hope that the pledge given in the title-page of this pamphlet has been fully redeemed? And if so, may I respectfully ask Professor Graham, and his clients,



whose analysis is "defective and unscientific?" May I further inquire if, as I have *casually* heard, the Professor has some time since, advised his clients to offer no more resistance to the confiscation of their "naphtha?" Aware possibly as he and they may be, that were the transaction brought into a court of law, the Counsel for the Crown might put such *cross* questions to their Autocrat of British Chemistry, as would compel him to relinquish his supremacy. If the above report be true, he might in common courtesy have signified to me the change of opinion produced by the testimony of some of his chemical friends, who had witnessed from the beginning the operations on his naphtha by Mr. Scanlan and myself, and some of its products, particularly the pint of perfect ether. Having laid a stumbling-block in the way of truth and justice, he was in duty bound to remove it whenever he became satisfied of its fallacious nature. True it is, that I have not received the slightest hint of any such acknowledgment from himself, though the channel through which I did receive it, is most respectably authentic. He must be conscious, from private circumstances of recent occurrence, that I entertained both respect and kindly feelings towards him, and that I was solicitous only for him to see the truth, and frankly to acknowledge it, in this important matter, affecting alike deeply the public interests, and my professional reputation.

Professor Brande has voluntarily come forward, and has openly made the *amende honorable* in the present affair to the extent, I believe, of his conviction, and for this he deserves the praise of candour; for it is certainly most unbecoming and disreputable in a man of science, whose sole object should be the pursuit of truth, to act the tortuous part of a pettifogging attorney, or to use towards a scientific associate, the casuistry of a special pleader under the bar. Such conduct is equally unwise, as it is ungenerous, since truth, and above all physical truth, will, sooner or later, clear itself from the cobwebs of sophistry.

I beg it to be distinctly understood, that I do not impute to the highly respectable firm of Messrs. Tennants, Clow, and Co., or to their partner, Mr. Cox, any design whatever of lending themselves to a fraud upon the revenue. Their declarations were made, I have no doubt, in complete ignorance of the real nature of the liquor consigned to them. Nay, further, the sophistication may possibly have been made by Mr. John Barling's workmen, without the connivance of their master. What I am sure of is this, that the said goods, and the other spurious naphthas, analyzed by me since, have been justly condemned as contraband by the Board of Customs. Three samples of naphtha, from a large cargo very recently imported into St. Catherine's

Docks, by the Wellington, were sent to me for analysis by the Landing Surveyor, on Friday, 21st April, and were found to be quite analogous to the sample reported on by me on the 29th March,—being composed to the amount of 95 per cent. of strong alcohol.

In the preface, I have used the epithet “sophistical,”\* in a chemical, not a moral, sense, for I know the gentleman, to whom allusion is made, to be quite incapable of any intentional deceit.

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\* Page vi.

THE END.

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#### ADDITION AND CORRECTIONS.

The discovery of Mr. Maurice Scanlan (not Morris, as misprinted, p. 24), adverted to p. 19, relates to a beautiful crystalline body of peculiar composition and properties, which he extracted from rough wood naphtha. It has been called pyroxyline, or pyroxantine, to indicate its pyroxylic origin, and its yellow colour.

P. 32, line 4, read “Believe me to remain,” *instead of* “Believe to remain.”  
 — 5 from bottom, read “alcohol,” *instead of* “alcoholic.”

